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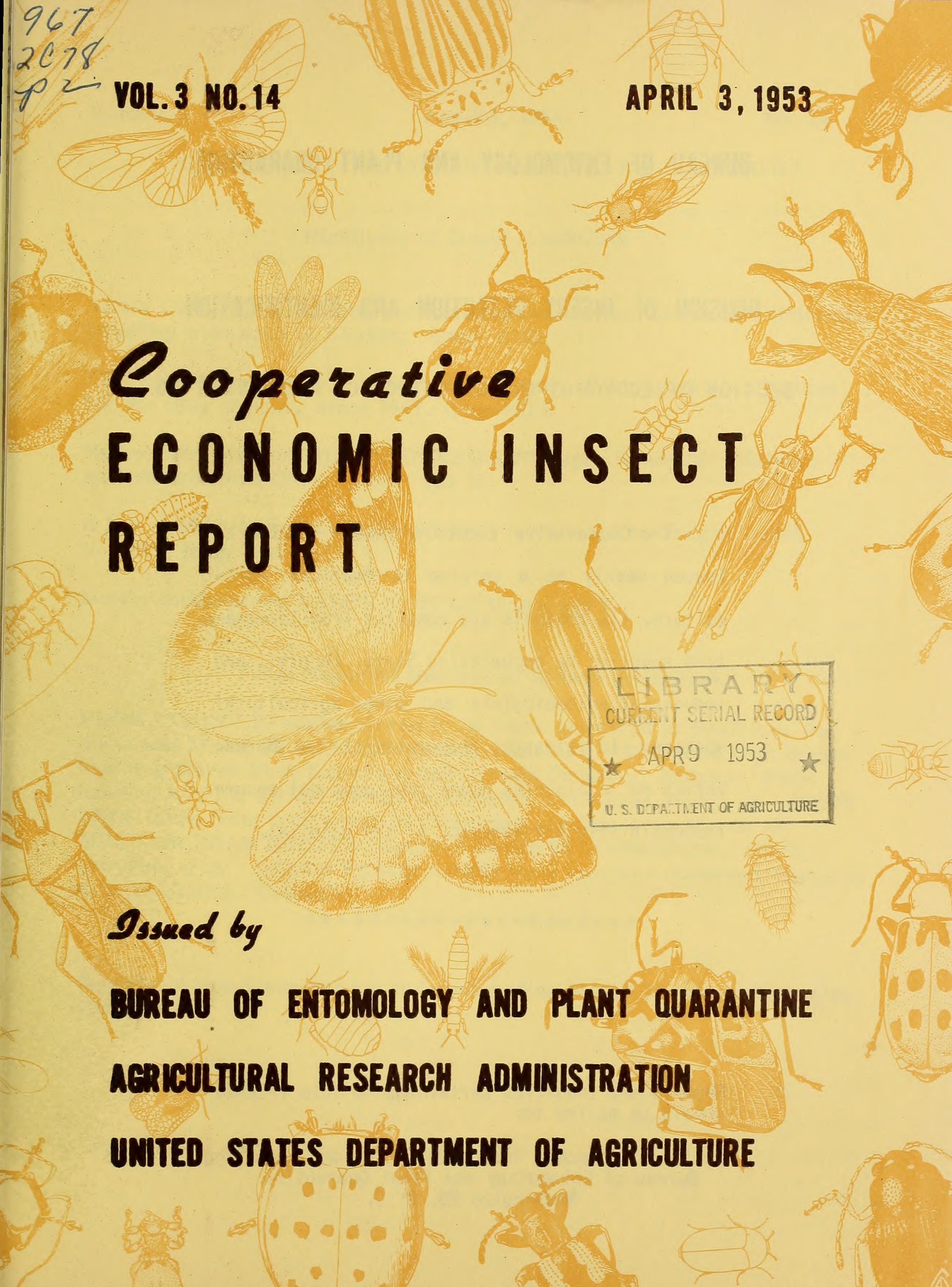

VOL. 3 NO. 14

APRIL 3, 1953

Cooperative ECONOMIC INSECT REPORT

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BUREAU OF ENTOMOLOGY AND PLANT QUARANTINE

AGRICULTURAL RESEARCH ADMINISTRATION

UNITED STATES DEPARTMENT OF AGRICULTURE

BUREAU OF ENTOMOLOGY AND PLANT QUARANTINE

DIVISION OF INSECT DETECTION AND IDENTIFICATION

SECTION OF ECONOMIC INSECT DETECTION AND REPORTING

The Cooperative Economic Insect Report is issued weekly as a service to American Agriculture. Its contents are compiled from information supplied by cooperating State, Federal, and industrial entomologists and other agricultural workers. In releasing this material the Bureau serves as a clearing house and does not assume responsibility for accuracy of the material.

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Section of Economic Insect Detection and Reporting
Bureau of Entomology and Plant Quarantine
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Volume 3 April 3, 1953 No. 14

COOPERATIVE ECONOMIC INSECT REPORT

Highlights of Insect Conditions

ARMY CUTWORM causing serious damage to wheat in eastern Colorado. Infesting wide area in Kansas. (page 220).

PEA APHID population on alfalfa in Gardena, Washington area highest, for the time of year, since 1947. (page 221).

Heavy carryover of EUROPEAN RED MITE eggs in southern Indiana and northeastern Ohio. (page 224).

A list of MOTHS taken in oriental fruit moth traps in Oregon - 1945 to 1952. (page 222).

Survey methods for LARCH SAWFLY (page 228).

First Reported Records of Season (by areas).

PLUM CURCULIO adults jarred from trees March 23 at Hazleton, Indiana and March 24 in Pulaski County, Illinois. APHIDS on fruit began hatching March 18 in Lawrence and Orange Counties, Indiana. First hatched APPLE GRAIN APHID in Wooster, Ohio area March 23. STINK BUGS taken from fruit trees in Vincennes, Indiana area March 27. MEXICAN BEAN BEETLE observed March 25 in Charleston, South Carolina area. GREEN PEACH APHID stem mothers observed March 23 at Fort Collins, Colorado.

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Reports in this issue are for the week ending March 28 unless otherwise designated.

The following letter relative to early season observations on the potato leafhopper has been received from Dr. G. C. Decker, Chairman, Committee on Surveys, Entomological Society of America. Your participation in this cooperative effort will be appreciated.

March 31, 1953

Dear Mr. Dorward:

Somewhere in southern United States the potato leafhopper (*Empoasca fabae*) has or will soon begin to increase in numbers preparatory to extensive migrations that will populate much of central and eastern United States. The committee on surveys of the Entomological Society of America is anxious to determine the course of this development and migration. To this end we respectfully urge that all survey workers cooperate with Dr. T. C. Allen,Department of Entomology, University of Wisconsin, Madison, Wisconsin, who is acting as coordinator for this special survey. Dr. Allen is in urgent need of 1st or early collection records from all sections of the country, particularly the south.

/s/ G. C. Decker
Chairman, Entomological
Society of America Committee
on Survey.

Dr. Allen uses the form reproduced below in the compilation of data.

NORTH CENTRAL STATES PROJECT ON INSECT OUTBREAKS
LEAFHOPPER SURVEY

State ________ Station ____________________________ Date ____________

Card and Lot No. ______________________

Species __________________________ Plant ____________________________

Est. Av. No. per sweep ____________ Growth __________________________

Adults: M ____ F ___ Nymphs ________ Size of field _________________ Acres

Remarks on weather or other factors possibly influencing population estimate

____

Reported by ______________________

WEATHER FOR THE WEEK ENDING March 31, 1953

Unseasonably warm, dry, rather windy weather prevailed in the Great Plains except for light to heavy showers in east-central portions on the 30th. High daytime temperatures generally ranged in the 50's or 60's in the extreme northern sections and in the 80's in the extreme south. Maximum temperature of 90 degrees or above occasionally occurred in the Rio Grande Valley of Texas; Presidio recorded 96 degrees on the 27th, and Laredo, 94 degrees on the 30th. Owing to these conditions the soil was too dry to plow in parts of Wyoming, considerable blowing dust occurred in parts of western South Dakota, western Nebraska, and eastern Colorado, stock water supplies continued short in parts of Kansas, and small grains in the driest sections made little or no improvement. Warm, dry weather also generally prevailed in the far West, except along the Pacific Coast where temperatures averaged slightly below normal and heavy rains fell in northern sections.

Rainfall was general east of the Mississippi River at the beginning of the period, with heavy amounts in the Northeast. Frequent rains in most of the Lake Region and in the Middle Atlantic and New England States during the remainder of the week ranged from very light over the Great Lakes to moderate to heavy along the Atlantic Coast. Weekly totals which ranged up to 6 inches in east-central Maine and 4 inches along the entire New England Coast, caused serious flood conditions in Maine and New Hampshire. Some flooding also occurred in New York where all streams were high. Moderate to heavy showers fell in Louisiana and Arkansas and a few surrounding areas on the 27th, and in Iowa, northwestern Illinois, northern Missouri, and eastern portions of Kansas and Oklahoma on the 30th. Rainfall for the week was very light from the Great Lakes to the Gulf and in the south Atlantic coastal areas.

Temperatures averaged 5 degrees to 10 degrees below normal in the Midwest and Southeast, and frost occurred on several mornings as far south as central Alabama and Georgia. The frost damaged some advanced fruit blossoms in Kentucky and Tennessee. In sharp contrast temperatures for the week averaged from 5 degrees to 10 degrees above normal in the Middle Atlantic and New England States and in the Rocky Mountian Region and western Great Plains.

At the end of the week the snowcover east of the Rocky Mountains had receded to small areas around Lake Superior and wooded mountainous sections in New York and New England. In the rivers of North Dakota, ice is melting or moving out without flooding. (Summary Supplied by U.S. Weather Bureau).

CEREAL AND FORAGE INSECTS

ALFALFA WEEVIL (Hypera postica) - DELAWARE - Adults and larvae active in stands of alfalfa 2 years or older in the Smyrna-Leipsic area. Injury is conspicuous on new growth. Most larvae are recently hatched, but some are more than half-grown. No evidence of the weevil or damage had been found by March 25 in stands seeded last fall. (Late News, Univ. Del.). COLORADO - Adults appearing in numbers, feeding on early spring growth in northeastern Colorado. Warm spring weather has encouraged activity. Insecticide applications underway. (L. B. Daniels).

ARMY CUTWORM (Chorizagrotis auxiliaris) - KANSAS - Attracting attention throughout much of the central part of the State, with scattered reports from western counties. Found in fields of fall-sown wheat and alfalfa in Saline, Ottawa, Philips, Kingman, Hamilton and Sedgwick Counties. Control measures are in progress in areas around Minneapolis and Wichita. Feeding just becoming evident, and no large amount of damage reported. Larvae are one-fourth to one-half grown in young wheat and alfalfa, but some larger larvae have been taken in old alfalfa fields. Populations so far reported would indicate that this pest is more abundant than average, but not sufficiently plentiful to be called an outbreak. (R. C. Smith). COLORADO - Serious damage to wheat in eastern Colorado. Three to 4 larvae per linear foot. Surveys and aerial applications of insecticides underway. (L. B. Daniels).

HESSIAN FLY (Phytophaga destructor) - KANSAS - Because of drought conditions, it would appear that wheat in most Kansas fields emerged late enough to escape fall fly infestation. In limited high moisture spots in some northern counties, light fall infestations occurred, principally in volunteer wheat which was present in many fields. Cooperative observations show that only light spotted infestations occur in a few northwestern counties with none being present in a great many other fields examined in western and central Kansas. It would appear that the fall population of hessian fly in the State was at a very low level. However, it is not inconceivable that a carryover of unemerged summer flies and the offspring of the scarce fall generation could cause trouble in some sections this spring if weather conditions should be favorable for fly development. (E. T. Jones).

MEADOW SPITTLEBUG (Philaenus leucophthalmus) - PENNSYLVANIA - Hatching in Chester County. (J. O. Pepper).

GREENBUG (Toxoptera graminum) - KANSAS - None seen or reported in wheat fields in the last few weeks. Scattered reports of very small numbers in wheat in southern and southwestern Kansas during the winter. No evidence of damaging numbers anywhere in the State. (R. C. Smith).

CRANE FLY (Tipulidae) - TENNESSEE - Unidentified larvae attacking fields of lespedeza in Dickson County. (R. P. Mullett).

PEA APHID (Macrosiphum pisi) - WASHINGTON - During the past week populations on alfalfa in the Gardena area have about doubled, and now average over 3 aphids per tip. This is the highest aphid population for the time of year in this area since 1947. A week or two of good weather will produce a population capable of doing some damage to alfalfa and early peas. (W. C. Cook, March 27). DELAWARE - Infesting redclover and alfalfa. (Late News, Univ. Del.).

CLOVER LEAF WEEVIL (Hypera punctata) - COLORADO - Causing damage to alfalfa in Boulder, Larimer and Weld Counties. (L. B. Daniels). WASHINGTON - Larvae damaging four fields of clover at Yakima. (B. J. Landis).

BLISTER BEETLES (Epicauta spp.) - FLORIDA - Extremely numerous on some lupine varieties in Gainesville area. (L. C. Kuitert).

A SPIDER MITE (Tetranychina apicalis) - FLORIDA - Infesting white and crimson clover and vetch in Gainesville area. Causing extensive damage to clover in localized areas. (L. C. Kuitert).

THREE-CORNERED ALFALFA HOPPER (Spissistilus festinus) - GEORGIA - Twelve adults per 50 sweeps of a net collected on alfalfa in Spalding County, March 24. (M. DuPree).

FRUIT INSECTS

Moths Taken In Oriental Fruit Moth Traps
Throughout Oregon 1945 to 1952

From 1945 to 1952 the Oregon State Department of Agriculture has conducted surveys by means of bait traps for oriental fruit moth. Many insect specimens have been taken in the traps which have not been determined definitely, but identifications of the following lepidoptera have been secured. (J. E. Davis).

Insect	Location
Abebaea subsylvella (oak leafworm)	Coos Junction, Barlow
Anarsia lineatella (peach twig borer)	All peach areas.
Anthophila pariana (apple and thorn skeletonizer)	Willamette Valley
Archips argyrospila (fruit tree leaf roller)	Willamette Valley
Archips rosaceana (oblique-banded leaf roller)	General
Archips rosana (filbert leaf roller)	Willamette Valley
Argyrotaenia citrana (orange tortrix)	General
*Badebecia urticana	Canby, Portland
Carpocapsa pomonella (codling moth)	General
*Chionodes mediofuscella	Fairview
*Chionodes trophella	The Dalles
*Clepsis fucana (larvae taken on rose leaves)	Roseburg
Cnephasia longana (omnivorousleaf tier)	General
Crambus sp. (sod webworm)	General
Ephestia elutella (tobacco moth)	Salem vicinity
Ephestia kuhniella (Mediterranean flour moth)	General
Epinotia emarginana (oak leaf roller)	The Dalles
*Epinotia lomonana	Meyers Creek
*Epizeuxis americalis	Gresham, The Dalles,Salem
*Euzophera ochrifrontella	Most areas
Gnorimoschema sp. (a gelechiid)	Mosier
Grapholitha caruleana	Mosier & Pendleton
Grapholitha molesta (oriental fruit moth)	Wasco & Malheur Counties
Grapholitha prunivora (lesser appleworm)	General
*Griselda radicana	Southern Oregon
Hofmannophila pseudospretella (scavenger moth)	General
Hypsopygia costalis (clover hayworm)	General and common
Lambdina fiscellaria race somniaria (hemlock spanworm)	The Dalles, Albany

Melissopus latiferreanus (filbert moth)	General
Mineola scitulella (destructive pruneworm)	The Dalles
*Mycterophora longipalpata	The Dalles, Portland, Corvallis
*Neoalcis californiaria	Wilsonville area
*Oligia tonsa	The Dalles, Gales Creek, Dayton
Pandemis pyrusana (apple pandemis)	The Dalles, Willamette Valley
*Platynota idaeusalis	Willamette Valley
Plodia interpunctella (Indian meal moth)	General
Proteoteras aesculana (maple twig borer)	Willamette Valley
Proteoteras willingana (boxelder twig borer)	Willamette Valley
Pyralis farianalis (meal moth)	Common and general
Recurvaria nanella (lesser bud moth)	Albany, Corvallis
Spilonota ocellana (eye-spotted bud moth)	General
*Tortricoides fragariana	The Dallas

*Common name unknown

* * *

PLUM CURCULIO (Conotrachelus nenuphar) - INDIANA - Two adults bumped from trees in abandoned orchard near Hazleton March 23. Last season adults first taken in Vincennes area April 18. (D. W. Hamilton). ILLINOIS - First of the season jarred March 24 in Pulaski County. (S. C. Chandler). GEORGIA - Adults had moved throughout peach orchards in Fort Valley area by March 23. (O. I. Snapp).

APHIDS (Aphidae) - NEW JERSEY - Eggs were abundant on most apple trees during the past winter. (A. J. Farley). INDIANA - Began hatching March 18 in Lawrence and Orange Counties. (G. E. Marshall).

APPLE APHID (Aphis pomi) - PENNSYLVANIA - Beginning to hatch in central area. (J. O. Pepper). INDIANA - Nymphs continued to be readily found in Vincennes area. (D. W. Hamilton).

ROSY APPLE APHID (Anuraphis roseus) - PENNSYLVANIA - Hatching in southeastern area. (J. O. Pepper).

WOOLLY APPLE APHID (Eriosoma lanigerum) - OHIO - Living immature forms are being found in aerial colonies on apple at Wooster. This is very unusual and attests to the very mild winter. (C. R. Cutright).

APPLE GRAIN APHID (Rhopalosiphum prunifoliae) - NEW JERSEY - Large percentage had hatched from Middlesex County south by March 25. (A. J. Farley). PENNSYLVANIA - Hatching in central areas. (J. O. Pepper). OHIO - First hatched individuals noted in the field March 23. (C. R. Cutright). ILLINOIS - Small to moderate numbers hatching in southern Illinois. (S. C. Chandler).

EUROPEAN RED MITE (Metatetranychus ulmi) - OHIO - Overwintering eggs are abundant in northeastern Ohio. (C. R. Cutright). INDIANA - Carryover of viable eggs heavy in Lawrence and Orange Counties. (G. E. Marshall).

RED-BANDED LEAF ROLLER (Argyrotaenia velutinana) - INDIANA - Adults still active in Vincennes area. (D. W. Hamilton).

PENTATOMIDS - INDIANA - Small number of stink bugs bumped from peach trees in Hazleton and Vincennes areas March 23. First of 1952 season found March 27. (D. W. Hamilton). ILLINOIS - Beginning to appear in southern Illinois. (S. C. Chandler).

TARNISHED PLANT BUG (Lygus lineolaris) - INDIANA - Adults bumped from peach trees near Vincennes, March 23. (D. W. Hamilton). Some activity noted on peach March 21 in Lawrence and Orange Counties. Buds not showing pink at this date. (G. E. Marshall). ILLINOIS - Small to moderate numbers on peach in southern Illinois. (S. C. Chandler).

CITRUS RUST MITE (Phyllocoptruta oleivora) - CALIFORNIA - Spring activity started in February in San Diego County. Medium local infestation occurred in Orange County. (S. Lockwood). FLORIDA - Activity increased on leaves and declined on fruit during the third week of March (Pratt and Thompson).

OMNIVOROUS LOOPER (Sabulodes caberata) - CALIFORNIA - This pest of avocados started activity on new foliage in San Diego County in February. (S. Lockwood).

SCALE INSECTS - INDIANA - Heavy carryover on apple in Lawrence and Orange Counties. (G. E. Marshall). CALIFORNIA - Heavy infestations of SAN JOSE SCALE (*Aspidiotus perniciosus*) on peach and cherry trees in San Joaquin County during February. Also during this period there were medium infestations of OLIVE SCALE (*Parlatoria oleae*) on apricot, peach and almond in Merced County; heavy infestations on plum in Kern County; and medium but local infestations on apricot, peach and plum in Glenn County. CALIFORNIA RED SCALE (*Aonidiella aurantii*) - emergence of crawlers started early in February in *Los Angeles County*. (S. Lockwood).

EASTERN TENT CATERPILLAR (*Malacosoma americana*) - MISSISSIPPI - Nests observed on peach, plum and wild cherry in Clay, Oktibbeha, Lowndes and Webster Counties. (J. G. Hester). GEORGIA - Larvae in nests in wild cherry in Peach County about one-half grown March 24. (O. I. Snapp).

LOOPERS (Geometridae) - GEORGIA - Much more abundant than usual in Fort Valley area peach orchards. (O. I. Snapp).

VEGETABLE INSECTS

MEXICAN BEAN BEETLE (*Epilachna varivestis*) - SOUTH CAROLINA - First adults of season noted in Charleston area March 25. More numerous than usual for time of year, but no eggs seen. (W. J. Reid). GEORGIA - Adults found on young commercial snap bean crop in Thomas County. No eggs or damage. Observed March 17. (F. S. Chamberlin).

COLORADO POTATO BEETLE (*Leptinotarsa decemlineata*) - SOUTH CAROLINA - Several additional adults observed in Charleston area, but no eggs seen. (W. J. Reid). GEORGIA - Light infestation of adults injuring tomatoes in a 10-acre field in Tift County, March 24. (L.W. Morgan).

GREEN PEACH APHID (*Myzus persicae*) - COLORADO - Eggs began hatching in Paonia area of western slope in February. Stem mothers observed March 23rd at Fort Collins. (L. B. Daniels). WASHINGTON - More abundant on winter-hardy plants at Yakima than for several years. (E. W. Davis).

POTATO APHID (*Macrosiphum solanifolii*) - WASHINGTON - More abundant on winter-hardy plants at Yakima than for several years. (E. W. Davis).

YELLOW-STRIPED ARMYWORM (*Prodenia ornithogalli*) - TEXAS - Attacking onions grown for seed in shadehouses in Winter Haven area. (B. H. Richardson).

CABBAGE LOOPER (*Trichoplusia ni*) - TEXAS - Causing considerable damage in the Winter Haven area; plane dusting being carried on. (B. H. Richardson).

DIAMONDBACK MOTH (*Plutella maculipennis*) - SOUTH CAROLINA - Adults numerous in a field of old cabbage in Charleston area. (W. J. Reid).

SEED-CORN MAGGOT (*Hylemya cilicrura*) - SOUTH CAROLINA - Causing slight injury in one small field of sprouting snap beans and slight to moderate injury in a 15-acre planting in Charleston area. (W. J. Reid).

TWO-SPOTTED SPIDER MITE (*Tetranychus bimaculatus*) - WASHINGTON - Adults and eggs moderately abundant on various weeds at Yakima. (B. J. Landis).

IRIS WHITEFLY (*Aleyrodes spiraeoides*) - WASHINGTON - Adults and eggs abundant on hardy weeds at Yakima. Eggs observed on sheltered plants since first week of February, but no larvae found till March 24. (B. J. Landis).

ARTICHOKE PLUME MOTH (*Platyptilia carduidactyla*) - CALIFORNIA - As high as 30 percent of artichoke buds infested in San Mateo County during February. (S. Lockwood).

A THRIPS (prob. *Thrips tabaci*) - CALIFORNIA - Reported responsible for considerable damage to onions in Riverside County during February. (S. Lockwood).

CUTWORMS (Phalaenidae) - SOUTH CAROLINA - Causing moderate damage in a recently-set 10-acre field of tomatoes and causing very light damage in most potato plantings in the Charleston area. (W. J. Reid).

GREEN JUNE BEETLE (*Cotinis nitida*) - TENNESSEE - Larvae attacking tobacco beds in scattered areas over Middle Tennessee. (R. P. Mullett).

FLEA BEETLES(*Epitrix* spp.) - TENNESSEE - Appearing in small numbers on tobacco beds in Middle and East Tennessee. (R. P. Mullett).

Tobacco Insect Conditions in Gadsden County, Florida area: One tobacco plant bed found heavily infested with green peach aphid (Myzus persicae). Young transplants appear to be generally free of injurious insects. A limited amount of cutworm (Phalaenidae) damage has been experienced in a few instances. Tobacco flea beetles (Epitrix hirtipennis) appear to be unusually numerous on some untreated plantings. (L. M. May).

COTTON INSECTS

Cotton Insect Conditions in Lower Rio Grande Valley, Texas: The over-all insect population in the Valley remains light. CUTWORMS are still causing some damage, especially in the Brownsville area. DARKLING BEETLES are reported from the McCook area but population seems light. THRIPS are causing damage in the Willacy County area, but there is no alarming infestations. Most of the infestations are found where onions and cotton are being grown close together. BOLLWORMS were reported from the Mission area and the Raymondville area. Light numbers are feeding in the terminals of cotton in the 6 to 10 leaf stage. Light infestations of SPIDER MITES and LEAF MINERS reported from several areas. (R. D. Griffith).

FOREST INSECTS

CANKERWORMS (Geometridae) - KANSAS - Adults have been emerging for more than a month, but numbers have been small. Indications that population will be heavier in Marshall County than most counties of the State. (R. C. Smith).

PALES WEEVIL (Hylobius pales) - MISSISSIPPI - Adults killing young pine trees in Jackson County. (G. L. Bond).

MISCELLANEOUS INSECTS

EASTERN SUBTERRANEAN TERMITE (Reticulitermes flavipes) - PENNSYLVANIA - Swarming in buildings in many sections of the State. (J. O. Pepper).

SURVEY METHODS

LARCH SAWFLY (Pristiphora erichsonii)
(as used in the Lake States)

Beginning in 1949, reconnaissance surveys of forested areas subject to sawfly attack have been conducted annually to assess not only the magnitude of the infestation, but the duration and intensity of attack preceding tree mortality. Depending on seasonal conditions, surveys are conducted during late July or early August. In these surveys combinations of aerial and ground methods have been used in Minnesota, while ground methods alone have been used in Wisconsin and Michigan. Because of the inaccessibility of most tamarack stands to ground travel, aerial methods have a peculiar advantage. With refinements in technique they seem to offer the greatest promise for compiling worthwhile annual records reflecting larch sawfly abundance.

Aerial Survey

Survey Plan: Aerial reconnaissance surveys in 1949 and 1950 consisted of planned random cruises of tamarack concentrations, especially those in national forest areas and in counties from which the sawfly had been reported. Experience during these earlier surveys indicated the need for a more comprehensive and systematic approach in using aerial methods to delimit zones of defoliation over large areas from year to year, and in 1951 this sort of an approach was taken. The system employed was an adaptation of the technique developed for spruce budworm surveys in the Northeast to meet the need for more accurate means of mapping defoliator damage than the sketch mapping method commonly used. Those familiar with timber cruising methods can best visualize it in comparison to a line strip cruise made on the ground. Evenly spaced flights are made over the forest at a constant altitude above the ground. Along the flight lines each observer examines a strip of timber and records his ocular appraisal of conditions viewed according to predetermined categories. This information is continuously transmitted via electrical keyboard to pens registering on the moving chart of an operation recorder. The observations registered on the chart of this instrument are then transcribedonto maps using any system which will permit connecting points of similar observations by isomorphic lines. A survey of this type has been designated an operation recorder aerial survey.

Equipment: A 5-passenger Cessna 195 high-wing monoplane was made available for the 1951 survey late in the summer by the U. S. Bureau of Entomology and Plant Quarantine's Beltsville, Md., forest insect laboratory. This plane was specially equipped for low altitude flying usually necessary in defoliator surveys. It contained, in addition to an Esterline-Angus operation recorder, and full length plexiglass doors for maximum visibility, a radio-altimeter and gyro compass to facilitate maintaining proper altitude and direction.

Procedure: In this survey the entire forested area of Minnesota north of Duluth (approximately 15 million acres) was covered by a system of parallel flight strips at 12-mile intervals, extending in an east-west direction. These flight strips were laid out in advance of aerial operations on large scale maps (1 inch - 2 miles), showing prominent topographic and cultural features, as well as the land subdivisions. . Such maps, compiled by the various states in cooperation with the U. S. Bureau of Public Roads, are available in most states. The individual map sheets were assembled into a single composite map of the entire areas to be covered. The course of each flight was plotted on the composite, and at convenient intervals readily recognizable points of reference, such as intersections with lakes, rivers, highways, etc., were designated by number along each course. These points of reference served as check points in maintaining the proper alignment of flights, and were identified by the pilot, who recorded the appropriate number in Morse code on the operation recorder chart as each was crossed. For convenient use in the airplane, the composite map was cut into strips, each containing about 3 flight lines, and folded.

The survey flights were made at an altitude of 500 feet above the ground and at an indicated airspeed of 120 miles per hour. Stand conditions were appraised by two observers, each viewing a separate strip approximately 5 chains wide on opposite sides of the plane. Conditions observed were classified according to five categories, and, through separate switchboards for each observer, were recorded on the operation recorder chart. The categories used were: (1) non-tamarack type; (2) water; (3) non-defolitated tamarack, i.e., no observable defoliation from 500 feet, although very light defoliation may have been present; (4) partially defoliated tamarack, i.e., defolitation easily observable, but varying amounts of green foliage present; (5) completely defoliated tamarack, i.e., all or almost all of the foliage destroyed. In this manner two separate, independent, and continuous strip samples were made the entire length of the respective flight lines. When the daily flying was done, proportional dividers were used to transfer the recorder chart data directly to the strip map. The plane speed between each check points was assumed to be constant, so that once the ratio between each pair of check points on the map and on the recorder chart was determined it was a simple matter to plot the portions of the strip in the different categories. A color code system was used to differentiate tamarack condition classes on each strip. For example, if red was the color which identified complete defoliation, a band of red would be inscribed at the exact places and for as long as was indicated by either or both observers. Thus, when tamarack condition classes on each strip were designated by the appropriate color, the picture for any given locality was readily apparent.

When the strip maps were reassembled into the original composite of the area covered, it was evident that the overall picture of damage was obscured by excessive detail at the 1-inch to 2-mile scale. To prepare the final map, it was necessary to group the strip data by townships. This was done by measuring the strip length in each township, and computing the percent of the sample in each tamarack condition class. The township was then given designation corresponding to the condition class in which 50 percent or more of the tamarack fell. For example, if the average length of strip for all tamarack condition classes in a given township was 4 miles, and 2 miles (50 percent) was classed as completely defoliated, the entire township was arbitrarily designated as being completely defoliated. On the basis of the values thus obtained, generalized zones of damage reflecting the different levels of larch sawfly infestation in tamarack stands were established.

Ground Survey

Plots are established throughout the infested area and adjacent uninfested tamarack type. Paint-marked stopping points along roads facilitate the operation, and attempts are made to paint-blaze sufficient trees, poles or boulders to make the spot easily identified from a moving vehicle. Paint-blazes also lead into the plot proper. Data are compiled from the percent defoliation (nearest 5 percent) of ten well spaced (2 chains if possible) paint-numbered tamarack trees. Ten minute cocoon collections are also made under three trees; totalling 1/2 man hour of work. In order to observe possible evidence of stand decadence, 1/12 -acre (1 chain by 1 chain) plots are also maintained at each defoliation plot. The bounds of this plot are amply painted in, and a hundred percent survey of each 4" or larger tamarack is made for eastern larch beetle (Dendroctonus simplex) which often attacks weakened trees. Data are kept on the total number of tamarack trees and those infested. (Division of Forest Insect Investigations).

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